Dear Editor Roman Skulec and reviewers Scott Goldberg and David Peran, thank you for your review, considerate feedback and for allowing us to provide a revised version of this manuscript. Please find below a point-by-point response letter to accompany the revised manuscript.

Response to Comments from Reviewer #1 Scott Goldberg, MD, MPH:
Comment: The article by Meadley, et al presents a scoping review of educational models for ultrasound training of paramedics in the out-of-hospital setting. Overall, it is well written and the methodology sound. With some minor revisions, it would make a welcome addition to the medical literature on the topic.

Response: Thank you for your encouraging comments and detailed feedback.

Comment: The background section nicely highlights the possible uses of point-of-care ultrasound (POCUS) in the field. Additional background as to the available training modalities for POCUS, including their benefits and limitations, would be welcome but is not essential. Further, the background might differentiate physician and non-physician systems of EMS care. Reference to "combined EMS providers (4.89) is somewhat confusing and could be better defined.

Response: This section (4.89) has been edited to read “This appears most apparent in EMS systems that use non-physician providers, including paramedics and nurses.2 Most studies report on EMS providers from a range of clinical backgrounds, and evidence pertaining to the clinical utility of paramedic use of POCUS is limited.”

Comment: The methods section is well written and appropriate. The search strategy is thorough and would seem to capture all appropriate references. The methods refer to exclusion of studies "if the participants were not exclusively paramedics" (5.136). This is confusing as many of the articles include EMTs, physicians, nurses, or other provider types. I imagine the authors meant that articles were excluded if they did not include paramedic providers, but this could be clarified.

Response: This section (5.136) has been edited to read “Studies were excluded if they were not written in English, or if they did not include paramedic providers.”

Comment: The results section is extensive and descriptive. The use of subheadings is not particularly helpful, and the authors may consider removing these, although this is not necessary. I question the inclusion of the study by Cappa et al (2015). This study appears to have been performed in the ED setting, and the differentiation between paramedics and nurses is unclear. The outcome measure, decreased placement of central lines, is not applicable to the out-of-hospital environment.

Response: Thank you for your comments regarding subheadings. We have retained them, as they form the foundation for our adherence to the Scoping Review methodology.

With regard to the Cappa et al (2015) study, the study looks at avoidance of central line placement by assessing competency of paramedics (and nurses) at placing ultrasound guided peripheral intravenous cannulae. It was performed in the ED setting, but our interpretation of the study is that once competency was achieved in the relatively controlled ED setting, paramedics would be able to translate this to the prehospital environment. This is commensurate with many other practical skills, including intubation, where initial competency is often gained in-hospital. As such, we have elected to retain the study.
Comment: In the discussion section, the authors reference a difference between "the critical care paramedic group" (12.292). However, groups are not clearly defined in the methods or results section, making this claim somewhat confusing. Likewise, they state that "data available at this time does not show a significant difference between the groups" (12.294). This review was not designed to evaluate statistical significance, so I would consider clarifying or rephrasing. The specific mention of the study by Golgalniceanu (12.300) seems out of place and might be removed. The authors state that paramedics might gain proficiency "regardless of base qualification, experience, duration or perceived quality of training (13.337) however immediately qualify this claim by citing a study in which providers had on average greater than 10 years' experience. This argument is confusing.

Response:

With regard to “critical care paramedics”, the paragraph (12.292) has been reworded as follows:

“In this study, paramedics with advanced training and/or extensive experience demonstrated a higher degree of accuracy in POCUS interpretation (where measured).23

Additionally, we have revised the sentence regarding “significance” to remove any suggestion of statistical analysis, which you correctly point out, was not part of the study:

“However, the data available at this time does not show a trend towards a difference between the groups, and a correlation to clinical outcomes is not able to be demonstrated, and is beyond the scope of this study.”

Regarding the Golgalniceanu study, the focus and direction of this paragraph (12.300) has been redirected and edited as follows:

“This scoping review suggests that the curricula used has varied considerably. Training duration ranged from a short 2-minute orientation session to two days with most sessions completed over a one-day course. Of interest, the literature reports POCUS curricula being implemented for physicians as early as the first year of medical school.32 In one study, Golgalniceanu et al. enrolled third and fifth year students in a 5-hour FAST course of which 85% of students completed a full FAST scan at an adequate level of performance in under 6-minutes.33 Should further studies demonstrate clear clinical utility of prehospital POCUS, then it may be reasonable to commence basic training in ultrasound during undergraduate paramedic training. Introduction of the skill early in the career of paramedics may strengthen anatomical knowledge, and allow for development of competence in POCUS over an extended period.”

Comment: Otherwise, the discussion is well written and thorough, and highlights many of the salient points regarding the challenges of ultrasound training to field providers. Particularly useful is the discussion of future directions, which might further highlight shortcomings in the existing literature.

Response: Thank you for your supportive comments.
Comment: Overall, this scoping review is well-written, thorough, and a welcome addition to the medical literature. The methodology is sound and the results comprehensive. The tables are formatted cleanly and would be a valuable resource to practitioners and researchers alike. I thank the authors for their work on this manuscript and for the opportunity to provide these comments.

Response: Thank you for taking the time to review our study. We very much appreciate your commentary.

Response to Comments from Reviewer #2 David Peran, MSc. BSc. PGDip:

Comment: Background: What do the authors consider as training in POCUS? The question is: Can be the 2 minutes introduction really called as training? There should be some definition of what is called training at the beginning.

Response: We define training in this instance any intervention aimed at increasing competency with use of POCUS. The Methods section (5.130) has been updated to reflect this definition.

Comment: I suggest moving part about differences in paramedic's training into the "Background" (page 12, line 287 - 290). The readers might have this question at the beginning of the article. It might be good to show earlier that the review counts with this variance.

Response:

The statement in the discussion has been retained, but we have amended the Background (4.87) as follows:

“The ability to accurately perform and interpret sonography is likely dependent on appropriate training and education of paramedics.2 General paramedic training can vary considerably, from vocational based-training through to formal tertiary education at the postgraduate level. With regard to demonstrating competence in POCUS, dependence on background education appears most apparent in EMS systems that use non-physician providers, including paramedics and nurses.2”

Comment: The manuscript is focused more on the description of the published studies in general and on the impact of described training, than on the educational curricula. The title and the aim of the research question is "Educational Curricula for Training Paramedic in Ultrasound". After this review authors did not show the curricula.

Response:

Thank you for this suggestion. The title of the paper has been changed to “Educational Standards for Training Paramedics in Ultrasound: A Scoping Review”. (1.1)

Comment: Conclusion: The suggestions for future research are meaningful. Authors includes also the fact that training and levels of paramedics are vary around a world, which can make
results of all future studies different. Authors should include into the suggestions also undergraduate paramedic training as a pre-preparation for future POCUS training.

Response:

An amendment has been made in the discussion (as suggested by another reviewer) as follows (12.306):

“Should further studies demonstrate clear clinical utility of prehospital POCUS, then it may be reasonable to commence basic training in ultrasound during undergraduate paramedic training. Introduction of the skill early in the career of paramedics may strengthen anatomical knowledge, and allow for development of competence in POCUS over an extended period.”

To the editor and reviewers, thank you for your valuable comments and suggestions. We hope that our modifications are satisfactory, and we the authors, look forward to hearing from you.